7.1.1: Imperial Measurements

Refer to the many different measuring units on the board at the front of the room. Your job is to take those measurement units and place them in the appropriate column below. **Don't forget to also write the name of an object that could be measured in that unit beside the unit**.

Length	Area	Volume	Mass

7.1.2: Measure This!

In the following table you will see many common school items. Your job is to estimate what you think the measurement of that item will be and then measure the item with the devices that are provided. It's important that you take a really good estimate before you measure. To keep things simple, you can estimate to the closest ½ unit (for example, if you are estimating the length of your arm, you might guess 1 ½ feet, 2 feet or 2 ½ feet).

ITEM	ESTIMATE	ACTUAL
Classroom Door Height	_____ ft.	_____ ft.
Blackboard Height	_____ ft.	_____ ft.
Blackboard Width	_____ yd.	_____ yd.
Textbook Width	_____ in.	_____ in.
Textbook Thickness	_____ in.	_____ in.
Volume of Locker	_____ ft^3.	_____ ft^3.
↳ height	_____ ft.	_____ ft.
↳ width	_____ ft.	_____ ft.
↳ depth	_____ ft.	_____ ft.
Length from your classroom door to the door next door.	_____ yd.	_____ yd.

7.2.1: Imperial Decisions

Fill in the following table by completing the ESTIMATE column first. When you have finished filling in the middle column, the actual conversions will be revealed.

IMPERIAL CONVERSION	ESTIMATE	ACTUAL
Inches to Feet How many inches are in ONE foot?		_____ in. = 1 ft.
Feet to Yards How many feet are in ONE yard?		_____ ft. = 1 yd.
Square inch to Square foot How many square inches are in a square foot?		_____ in^2 = 1 ft^2
Square foot to Square yard How many square feet are in ONE square yard?		_____ ft^2 = 1 yd^2
Cubic inch to Cubic foot How many cubic inches are in ONE cubic foot?		_____ in^3 = 1 ft^3
Cubic foot to Cubic yard How many cubic feet are in ONE cubic yard?		_____ ft^3 = 1 yd^3

7.3.1: Body Parts

INCH Originally was the length of three barley grains placed end to end. Distance from tip of thumb to first knuckle, or from first to second knuckle on index finger.

My INCH = _____ INCHES

FOOT Length of foot from longest toe to heel

My FOOT = _____ INCHES

YARD Distance from tip of nose to end of thumb with arm outstretched (cloth merchants, King Henry I)

My YARD = _____ INCHES

HAND Width of one hand, including the thumb (height of horses)

My HAND = _____ INCHES

CUBIT Length from point of bent elbow to middle fingertip (Egyptian pyramids, Noah's ark)

My CUBIT = _____ INCHES

BRACCIO Italian for "an arm's length" (Da Vinci's parachute)

My BRACCIO = _____INCHES

FATHOM From the Anglo-Saxon word for "embrace," it was the length of rope held between two hands with the arms outstretched. (sailors)

My FATHOM = _____ INCHES

PACE Length of a single step. In Roman times one pace was a double step, and our MILE came from the Latin mille passuum, meaning 1000 paces.

My PACE = _____ INCHES

7.3.2: A Question of Converting

CONVERSION	ESTIMATE	ACTUAL
Centimetres to Inches How many cm are in ONE inch?	3	_____ cm = 1 in.
Centimetres to Inches How many cm are in ONE inch?		_____ cm = 1 in.
Decimetre to Feet How many dm are in ONE foot?		_____ dm = 1 ft.
Meters to Yards How many meters are in ONE yard?		_____ m = 1 yd.
Cubic centimetres to Cubic inches How many cubic cm are in ONE cubic inch?		_____ cm^3 = 1 in^3
Meters to Feet How many meters are in ONE foot?		_____ m = 1 ft.
Meters to Yards How many meters are in ONE yard?		_____ m = 1 yd.
Squared centimetres to Square inches How many squared cm are in ONE square inch?		_____ cm^2 = 1 in^2
Squared meters to Squared feet How many squared meters are in ONE square foot?		_____ m^2 = 1 ft^2
Squared meters to Squared yards How many squared meters are in ONE squared yard?		_____ m^2 = 1 yd^2
Meters cubed to Yards cubed How many cubic meters are in ONE cubic yard?		_____ m^3 = 1 yd^3
Cubic decimetres to Cubic feet How many cubic dm are in ONE cubic foot?		_____ dm^3 = 1 ft^3

7.3.3: Convertible Numbers

Let's practice converting some numbers from metric to imperial units (and vice versa).

How many meters are there in 13 yards?

1. yards : meters
2. 1 : 0.9144 (X 13 / x 13)
3. 13 : _____

This is a technique called the Ratio Method of converting. It consists of three steps:

1. Set up a ratio in words.
2. Use the conversion table
3. Create equivalent ratio

0.9144 x 13 = 11.8872

Therefore there are about 11.89 meters in 13 yards.

Let's try another!

How many squared inches are there in 9 squared centimetres?

Ratio → $inches^2 : cm^2$

Conversion Factor → 1 : 6.45 (x 1.395)

Equivalent Ratio → _____ : 9

1 x 1.395 = 1.395 in^2

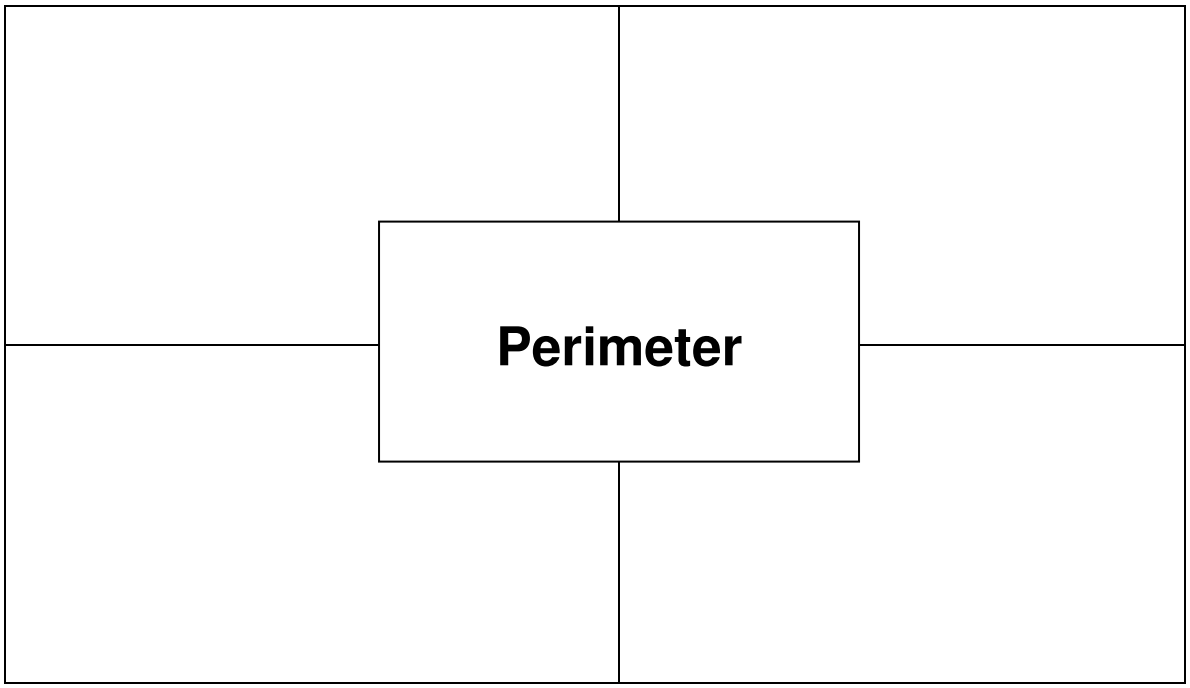
Therefore there are 1.395 in^2 in 9 cm^2.

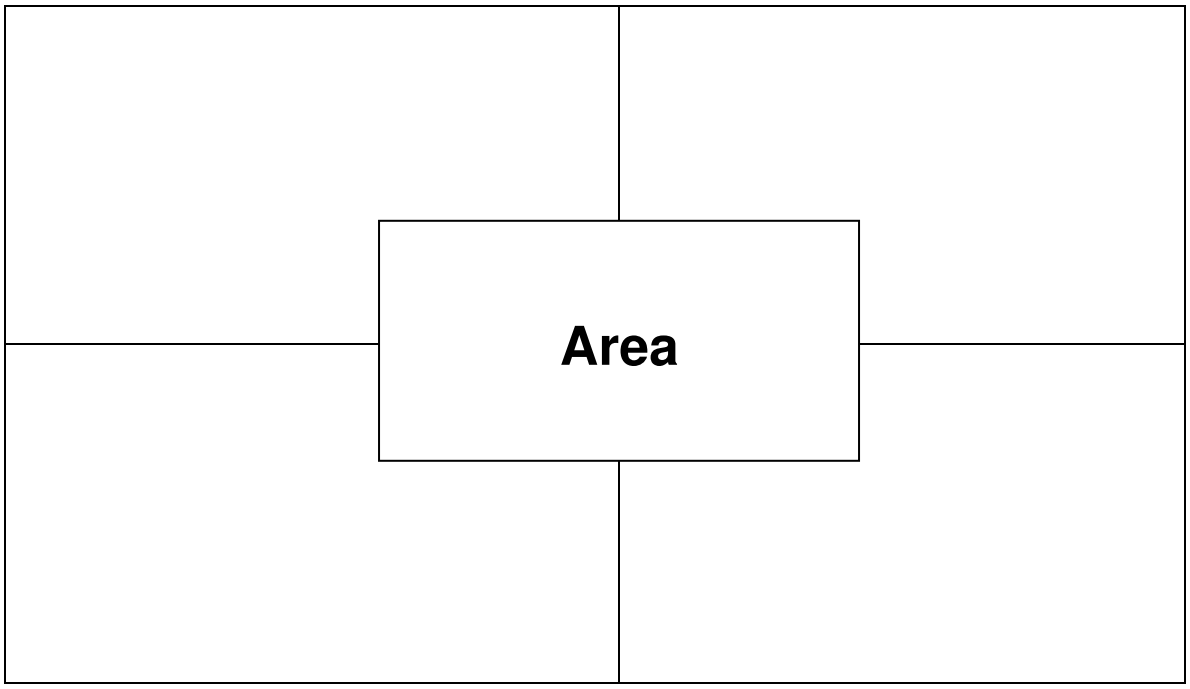
7.3.3: Convertible Numbers (Continued)

Try the following conversions using your conversion table and the Ratio Method (or any method of your choice).

If you bought a 24 foot ladder, how many meters would it be?	How many squared feet is a house that measures 42 squared meters?
If a bag of salt holds 150 cubic inches, how many cubic centimetres does it hold?	The length of a CFL football field is 160 yards from end-zone to end-zone. How many meters long is the field?
Joe is 1.75 meters tall. How many feet tall is Joe?	One can of paint is enough to paint 500 squared feet. How many squared meters can you paint with this one can?

7.4.1: Placemat: Perimeter and Area





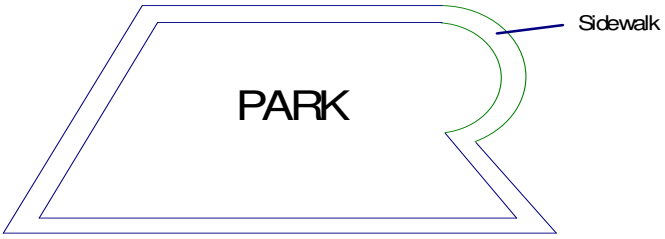
7.4.2: Let's Convert!

Complete the conversions in the chart below

1 in	_____cm
1 ft	_____cm
1 ft^2	_____cm^2
1 m (100 cm)	_____in
1 m	_____ft
1 m^2	_____ft^2
1 yds	_____ ft
1 yds^2	_____ ft^2
1 kg	_____lbs
1 kg	_____grams
_____kg	1 lbs
1 ft^3	_____cm^3
1 m^3	_____cm^3
1 m^3	_____ft^3

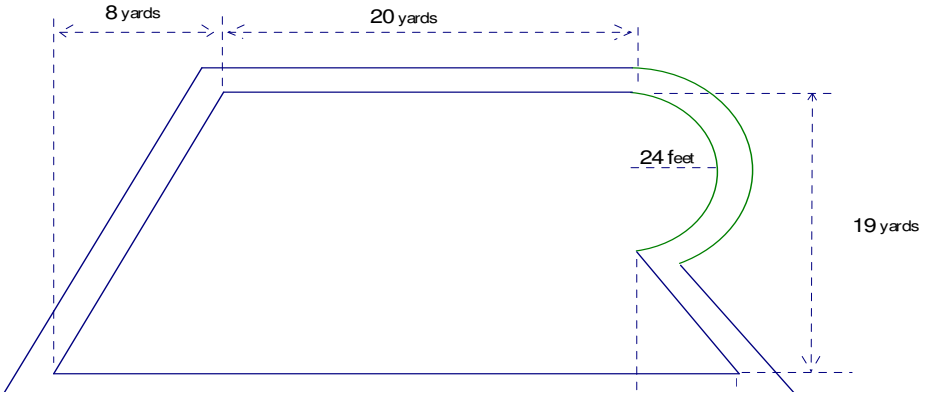
7.4.3: Proposing the Park

Sham City, has asked your landscaping company to submit a proposal estimating the cost of completing the construction of a memorial park. Your company needs to sod the park as well as plant a small hedge along the *inside* of the paved sidewalk that is located around the parks' perimeter.



Project A: The Sod

Below is a sketch of the park with its corresponding dimensions. Note that the uniform paved sidewalk surrounding the green space is 1.5 yards wide.



To determine the amount of sod required, you will need to find the total area of the park.
Since you know how to find the areas of basic shapes (e.g. circles, rectangles and triangles), you should try to break up the park into basic shapes and determine the areas of each.

1. Examine the inside area that is to receive sod. Draw line segments that will break up the field into basic shapes (you may have duplicated shapes).

7.4.3: Proposing the Park (Continued)

2. Draw the basic shapes in the space below. Be sure to include the dimensions of each shape. You may or may not use all of the space provided below.

Basic Shape 1:_____	Basic Shape 2: _____
Basic Shape 3:_____	Basic Shape 4: _____

3. Determine the area for each of your basic shapes drawn above, to 1 decimal place.

Area Basic Shape 1:_____	Area Basic Shape 2: _____
Area Basic Shape 3:_____	Area Basic Shape 4: _____

7.4.3: Proposing the Park (Continued)

4. Calculate the total area of the park that will receive sod, to 1 decimal place. State your solution using the following units:

(i) square feet

(ii) square meters

5. If each roll of sod covers 16 square feet, how many rolls of sod need to be ordered to complete the job.

6. Sham City must use a special fertilizer for their grass to grow due to their northern climate. This fertilizer comes in 15lb bags that cover 250 m^2 of new laid sod. How many bags of fertilizer will be required to cover the lawn?

Project B: The Hedge

To determine the total amount of hedging needed, we need to calculate the total perimeter of the park. Recall that the small hedges are to be planted along the *inside* of the path

7.4.3: Proposing the Park (Continued)

1. In the spaces below, draw the basic shapes that were found in Part A.

Basic Shape 1:_____	Basic Shape 2: _____
Basic Shape 3:_____	Basic Shape 4: _____

2. Using a different colour pencil, highlight the sides of each shape that will receive hedging.

3. In the spaces below, calculate the length of each coloured side you found in the previous question (Question 2 above).

Perimeter Basic Shape 1:_____	Perimeter Basic Shape 2: _____
Perimeter Basic Shape 3:_____	Perimeter Basic Shape 4: _____

7.4.3: Proposing the Park (Continued)

4. Find the total perimeter of the park that is to receive hedging. State your solution using the following units:

   (i) feet

   (ii) meters

5. If each 'hedge plant' takes up 1.5 feet, how many 'hedge plants' are needed to surround the park?

Part C: The Cost

The local nursery is selling the exact hedge you have chosen for the park. The sale price for the hedge is $12 per linear meter. Also, the sod price is $2.50 for a roll. If you have to pay 13% tax, what would be the total cost for the sod and hedge?

7.4.4: Proposing the Park - Rubric

Thinking-'Reasoning and Proving'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Degree of clarity in explanations and justifications in reporting	Explanations and justifications are partially understandable	Explanations and justifications are understandable by me, but would likely be unclear to others	Explanations and justifications are clear for a range of audiences	Explanations and justifications are particularly clear and detailed
Making inferences, conclusions and justifications	Justification of the answer presented has a limited connection to the problem solving process and models presented	Justification of the answer presented has some connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented	Justification of the answer has a direct connection to the problem solving process and models presented, with evidence of reflection
Application-'Connecting'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Communication-'Communicating'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Ability to read and interpret mathematical language, charts, and graphs	Misinterprets a major part of the information, but carries on to make some otherwise reasonable statements	Misinterprets part of the information, but carries on to make some otherwise reasonable statements	Correctly interprets the information, and makes reasonable statements	Correctly interprets the information, and makes subtle or insightful statements
Correct use of mathematical symbols, labels, units and conventions	Sometimes uses mathematical symbols, labels and conventions correctly	Usually uses mathematical symbols, labels and conventions correctly	Consistently uses mathematical symbols, labels and conventions correctly	Consistently and meticulously uses mathematical symbols, labels and conventions, recognizing novel opportunities for their use
Appropriate use of mathematical vocabulary	Sometimes uses mathematical vocabulary correctly when expected	Usually uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly, recognizing novel opportunities for its use

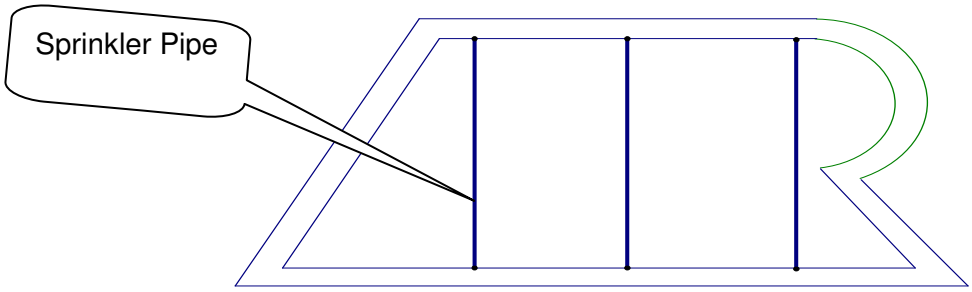
7.5.1: Job Opportunity

Your proposal for the memorial park in Sham City has been carefully reviewed. They were so impressed with the plan that they have decided to also have you install an irrigation system throughout the park. They need a cost proposal from you to see if they can afford this 'drip' and 'soaker' system in addition to the cost of the sod and hedges.

Note: You will need to refer to your answers from the previous lesson activity for Sham City to complete this cost proposal.

Part A: The SOD

1. There is a by-law in Sham City that states that all city parks must have an underground 'drip' sprinkler system. The city gives you the design below that indicates approximately where the plastic underground pipes must go.



a) If pipes come in 5 m lengths, how many pipes need to be purchased for the underground sprinkler system?

b) What will the cost be if each length costs $7.19?

7.5.1: Job Opportunity (Continued)

c) The sod requires plenty of water for optimal growth. The ratio of 1 m^3 of water for every 25 m^2 of sod is needed daily. How many cubic meters of water are required daily for the sod to grow?

d) If it costs the city \$0.03/ft^3 of water, how much will it cost to water the park daily?

Part B: The Hedge

1. To make sure the hedge receives enough water, the city needs to place an underground irrigation system that is made specifically for hedges, called a 'soaker line'. Its price is \$1.83 per linear meter. Determine the cost of the irrigation system for the hedge.

Part C: The Proposal

Complete a proposal to Sham City. Your proposal should be one paragraph. Be sure to include the following:

- The amount of sod and hedging needed in metric units
- The cost of the sod and hedging.
- The cost of the entire irrigation system needed for the sod and hedge.
- Summarize the proposal with a total cost.

Included with your proposal paragraph should be a drawing of the park labeled in metric units. This will be handed in to the teacher to be assessed.

7.5.2: Job Opportunity - Rubric

Thinking-'Reasoning and Proving'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Degree of clarity in explanations and justifications in reporting	Explanations and justifications are partially understandable	Explanations and justifications are understandable by me, but would likely be unclear to others	Explanations and justifications are clear for a range of audiences	Explanations and justifications are particularly clear and detailed
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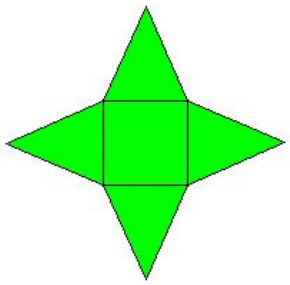
7.6.1: Is the NET Up or Down?

Some say the surface area of a **square-based pyramid** is equal to the sum of the areas of a square and four identical triangles. Let's Investigate.

Part A: The NET

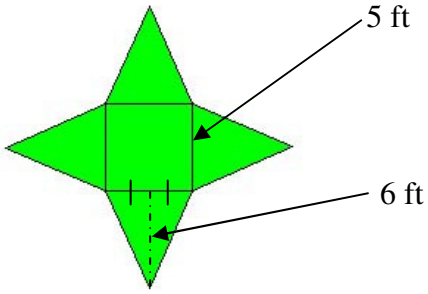
1. Examine the following net. Identify & label the square  and the 4 identical triangles.

2. To calculate the area of this 2 dimensional net, we need to:
   a. First, find the area of the square, using

$$A_{square} = (length)(width)$$

   b. Second, find the area of one triangle, using

$$Area_{triangle} = \frac{(length\ of\ base)(height\ of\ triangle)}{2}$$



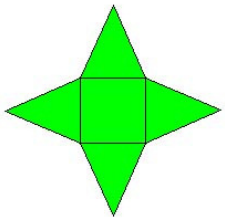
   c. The next step is to multiply the area of the triangle by 4. Explain why you think this step is necessary.
   .

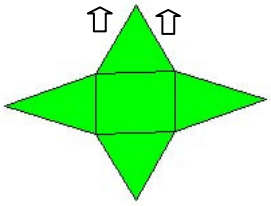
   d. Finally, the total area of the net is the sum of the areas of the square and the triangles. Determine the total area.

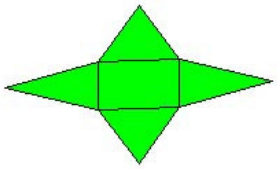
7.6.1: Is the NET Up or Down? (Continued)

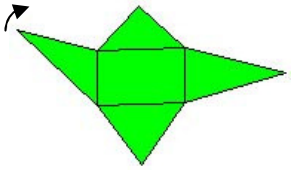
Part B: The Folding-Up of the Net!

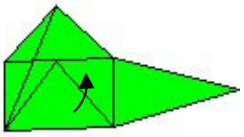
1. Now we are going to fold the net to create a square-based pyramid. Follow the stages below.

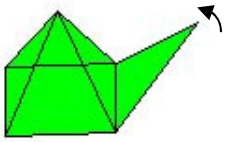

Stage 1: The NET

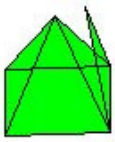

Stage 2: Tilt Back

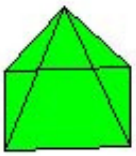

Stage 3: Tilt Further back


Stage 4: The Folding-Up Begins

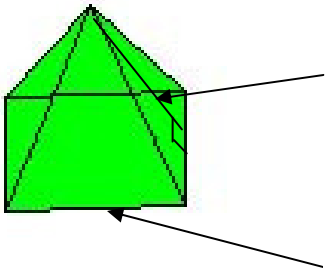

Stage 5: Half-Way There!


Stage 6: Last Triangle


Stage 7: Almost There!


Stage 8: Complete!

2. Take the 'stage 8' diagram and locate the measurements from part A on the pyramid.



___ft

This is called the **slant height** of the pyramid, h_s, which bisects the base.

___ft

This is the base of the pyramid, *b*

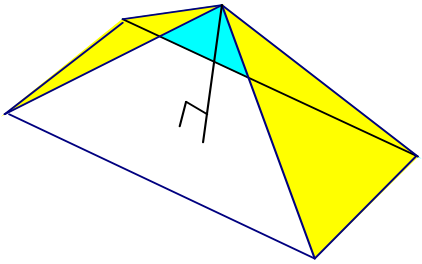
3. Create a formula to find the surface area of any square-based pyramid using '*b*' for the length of the base and 'h_s' for the length of the slant height. Use the equation format below as a guide.

$$\mathbf{SA}_{\text{square-based pyramid}} = (\quad)^2 + 4(\qquad)$$

7.6.2: Rectangular-Based Pyramids

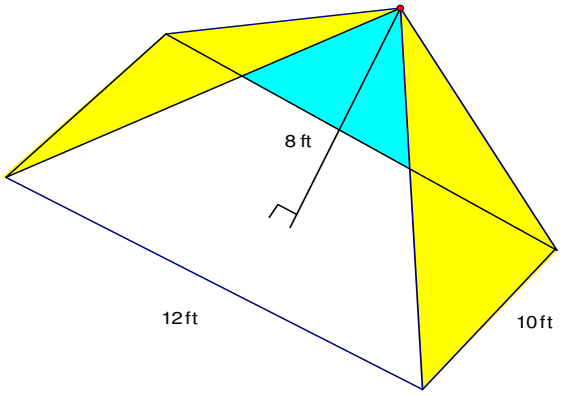
Part A: Rectangular Base Formula

- Identify the slant heights, length and width of the rectangular base.
- Create a formula to calculate the surface area of a rectangular-based pyramid.
- Sketch the net of this rectangular-based pyramid.



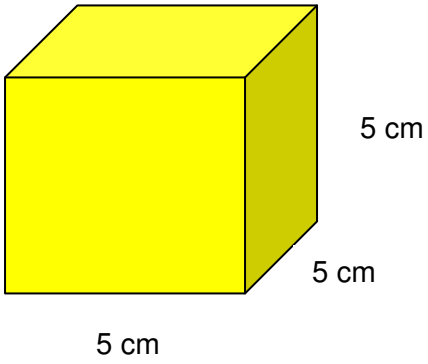
Part B: Rectangular Base Surface Area

- Determine the slant heights of each triangle with the help of the Pythagorean Theorem.
- Calculate the total surface area of the object.

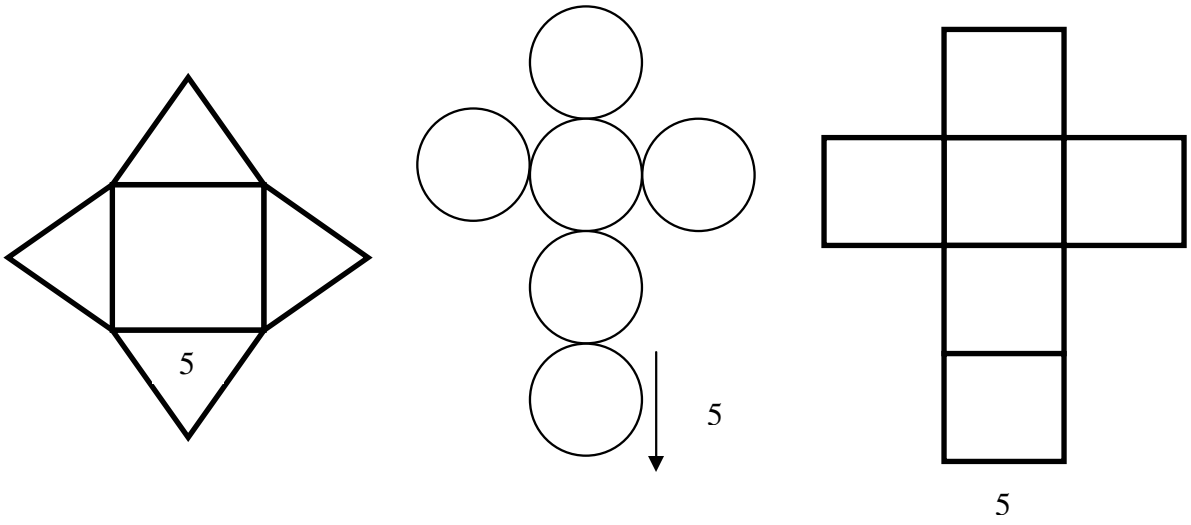


7.7.1: Which Net?

Take a look at the rectangular prism.



a) Which one of the following nets below would create this prism? Circle your choice.



b) Explain how you know that you are right.

c) Find the area of each shape in the net that you selected.

7.7.2: Cuboid Creations

You will be given 27 linking cubes. Your mission is the following.

a) Using all 27 linking cubes, create three *different* rectangular prisms that can be made.

b) Using the isometric dot paper provided, draw each of your creations. Please note that one of your creations will not be able to be drawn because of size limitations.

c) Fill in the following table for your three creations:

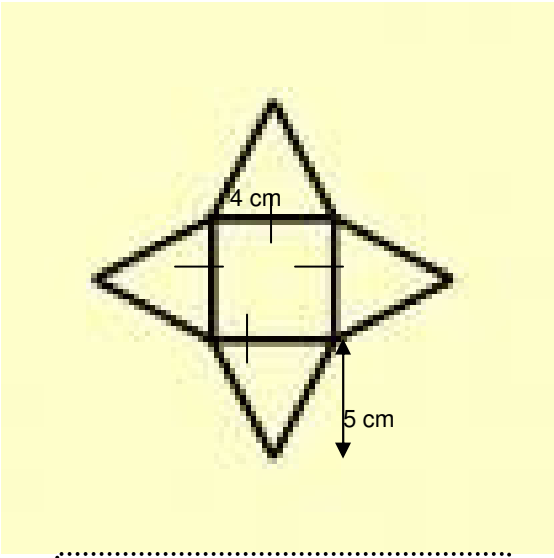
3-D Sketch of prism (with dimensions labelled)	Surface Area (count the squares)	Number of Surfaces	Area of each surface recorded and added up.

d) What do you notice about the 2nd and 4th column?

e) Write your own definition for Surface Area based on what you answered in d).

7.7.3: Net Worth

Take a look at the following net.



Recall that the formula for finding the area of a triangle is:

$A = (b \times h) \div 2$

a) Number the shapes in the above net from 1 to 5.

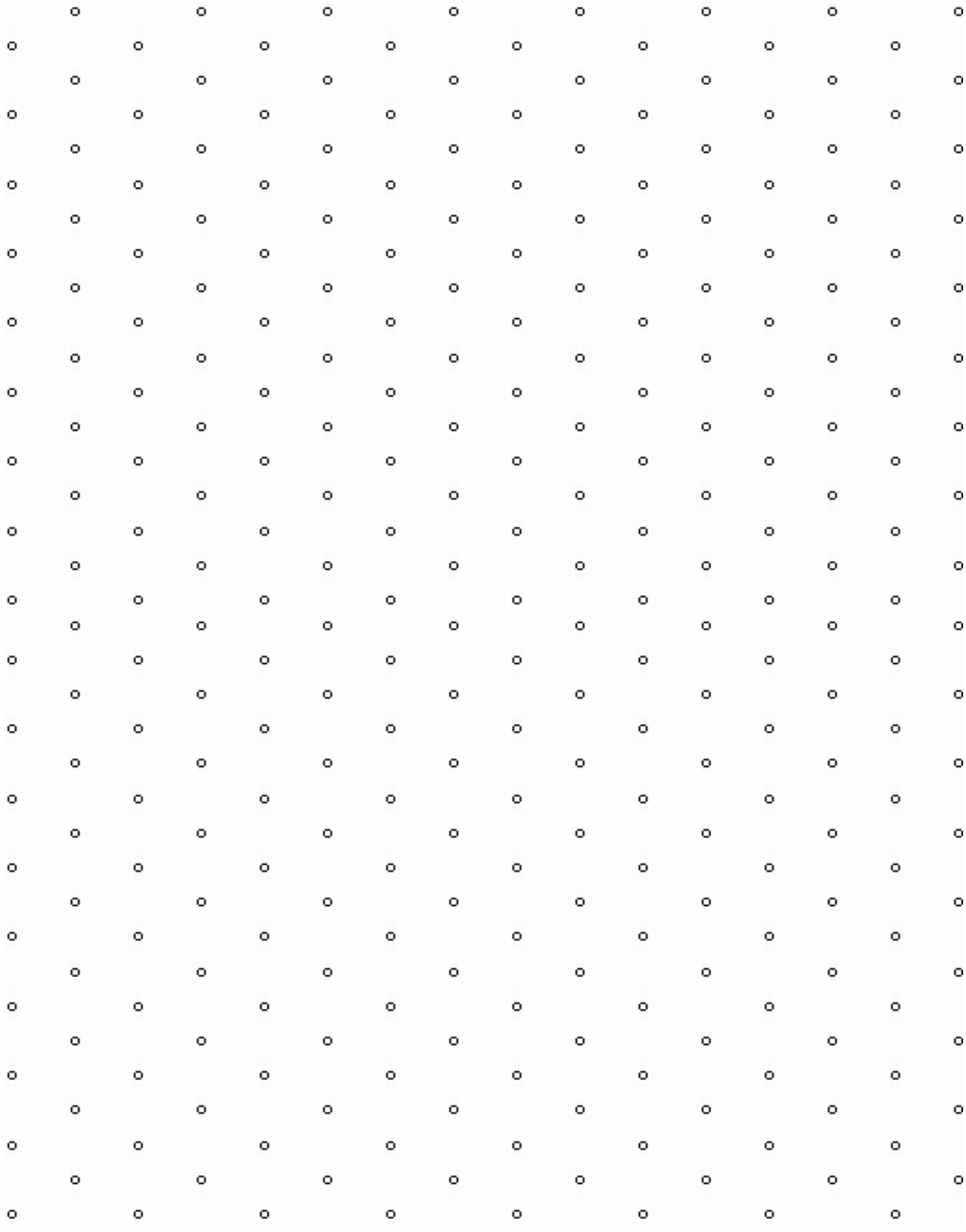
b) Using the chart below, calculate the area of each shape in the above net.

Shape	Area Calculations
1	
2	
3	
4	
5	

c) What 3-D shape would be formed by this net?

d) What would the surface area of this 3-D shape be?

7.7.4: Isometric Dot Paper



7.8.1: Pick a Square, Any Square

On the board, you should see many different sized squares labelled with a unit.

For each of the items in the chart below, select the square unit that you think would be best for describing the *size* of the item. Once you have selected the square unit, make an estimate as to how many squares you think could fit inside the item.

Item	Best Square Unit	Estimated Size (Area)
Classroom Floor		
Front of Math Textbook		
Thumbnail		
Blackboard/Interactive White Board		
One Classroom Window		
Classroom Door		
Clock in Class		

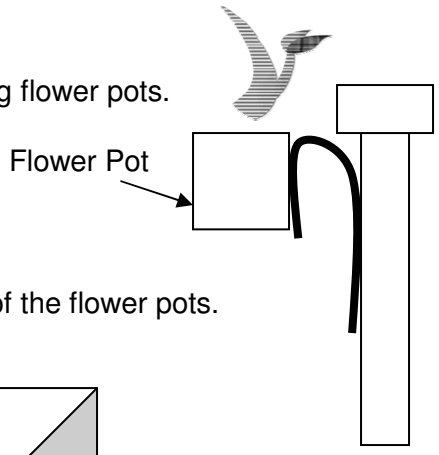
Exchange your chart with a partner when instructed. There is a chart below for your partners' comments.

Partner's Name _____

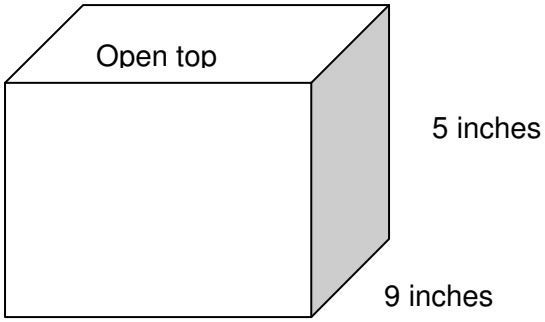
Item	Comments (Do you agree with your partners' estimates?)
Classroom Floor	
Front of Math Textbook	
Thumbnail	
Blackboard/ Interactive White Board	
One Classroom Window	
Classroom Door	
Clock in Class	

7.8.2: Planter's Dilemma

Joe is going to paint his hanging flower pots.



Here is a close up look at one of the flower pots.



1. How much paint would Joe need (in square inches) to paint the outside of ONE flower pot?

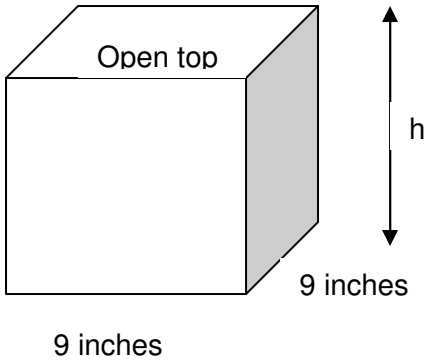
2. How many **square feet** of paint is needed?

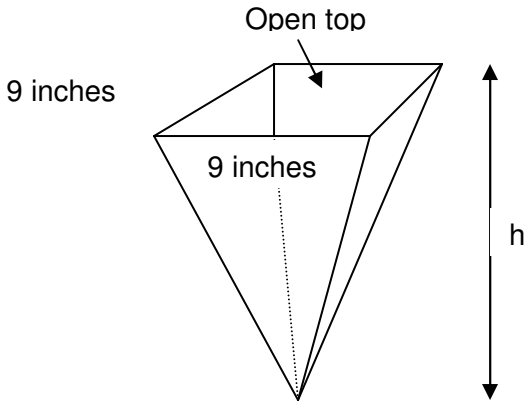
Note: You may need to refer to one of your conversion tables that was made earlier in the unit.

7.8.2: Planter's Dilemma (Continued)

3. If one quart of paint is enough to paint 10 ft^2, how many quarts will Joe need to buy in order to paint his **10** flower pots?

4. Joe has some other decisions to make about his flower pots. Take a look at two of the other flower pots that Joe could have bought.





What would the height of the each of these two flower pots have to be in order to need exactly TWICE as much paint as one of Joe's current flower pots?

7.8.2: Planter's Dilemma (Continued)

4 (continued).

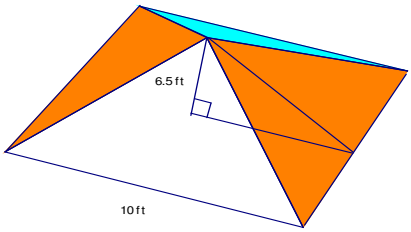
Square Based Prism	Square Based Pyramid

7.8.3: Applications

1. Find the area of the floor and the amount of glass used to build the latest addition to the entrance of the Louvre, the world-famous museum in Paris, France. Its base measures 116 ft long.

http://www.guide-to-symbols.com/pyramid/

2. A tent that has a square base and a height of 6.5 ft needs a canvas cover.



a. Identify the base, b and the slant height, h_s.

b. Is there another calculation you need to complete prior to using the surface area formula for square-based pyramids? Explain.

c. Calculate the h_s for the tent.

e. Determine the amount of canvas needed to cover the tent (Hint: The floor of the tent is not made of canvas!).

7.8.4: Planter's Dilemma Rubric

Selecting Computational Strategies				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Select and use strategies to solve a problem	Selects and applies appropriate strategies, with major errors, omissions, or mis-sequencing	Selects and applies appropriate strategies, with minor errors, omissions or mis-sequencing	Selects and applies appropriate strategies, accurately, and logically sequenced	Selects and applies the most appropriate strategies, accurately and logically sequenced
Communicating				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Ability to read and interpret mathematical language, charts, and graphs	Misinterprets a major part of the information, but carries on to make some otherwise reasonable statements	Misinterprets part of the information, but carries on to make some otherwise reasonable statements	Correctly interprets the information, and makes reasonable statements	Correctly interprets the information, and makes subtle or insightful statements
Correct use of mathematical symbols, labels, units and conventions	Sometimes uses mathematical symbols, labels and conventions correctly	Usually uses mathematical symbols, labels and conventions correctly	Consistently uses mathematical symbols, labels and conventions correctly	Consistently and meticulously uses mathematical symbols, labels and conventions, recognizing novel opportunities for their use
Appropriate use of mathematical vocabulary	Sometimes uses mathematical vocabulary correctly when expected	Usually uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly, recognizing novel opportunities for its use
Integration of narrative and mathematical forms of communication	Either mathematical or narrative form is present, but not both	Both mathematical and narrative forms are present, but the forms are not integrated	Both mathematical and narrative forms are present and integrated	A variety of mathematical forms and narrative are present, integrated and well chosen
Connecting				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections

7.9.2: Constructing Cylinders

Use the following table to keep track of different cylinders you attempt to construct using Geometer's Sketchpad. Once you get one that works, circle it, cut it out and see if it makes a cylinder.

For instructions on how to use the Geometer's Sketchpad (GSP) see sheet 7.9.4.

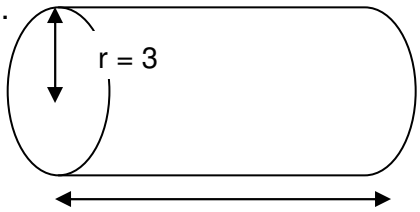
#	Radius of the Circle on top	Circumference of the Circle $C=2\pi r$	Area of Both Circles Combined $A = \pi r^2$	Dimensions of the Rectangle (length & width)	Area of the Rectangle A = l x w	Total Area of the Cylinder
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Describe any strategies that you used.

7.9.3: Cylinder Surfaces

Below you will find two cylinders. You need to calculate their total surface areas.

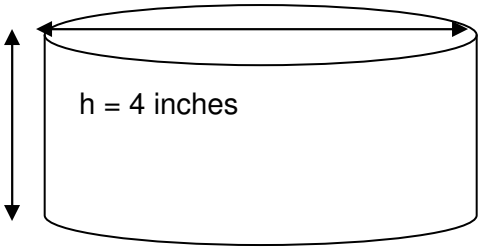
1.



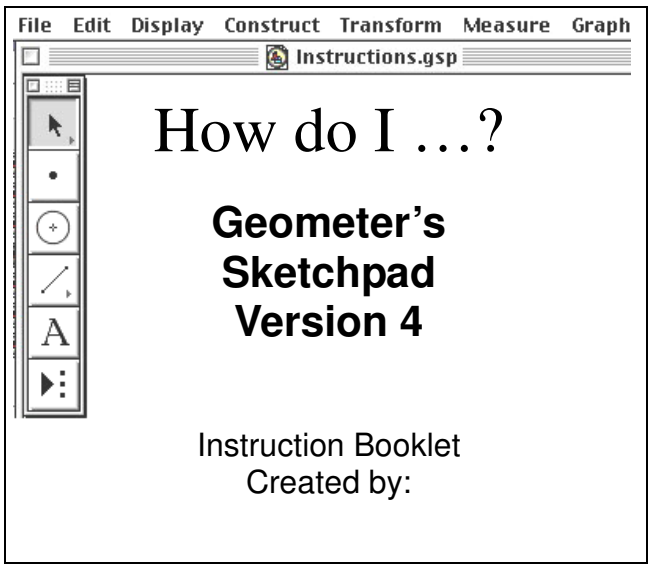
h= 12 cm

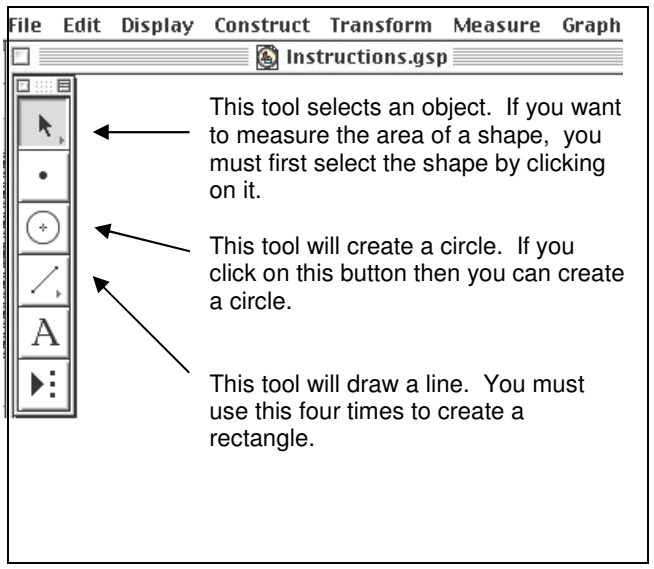
2.

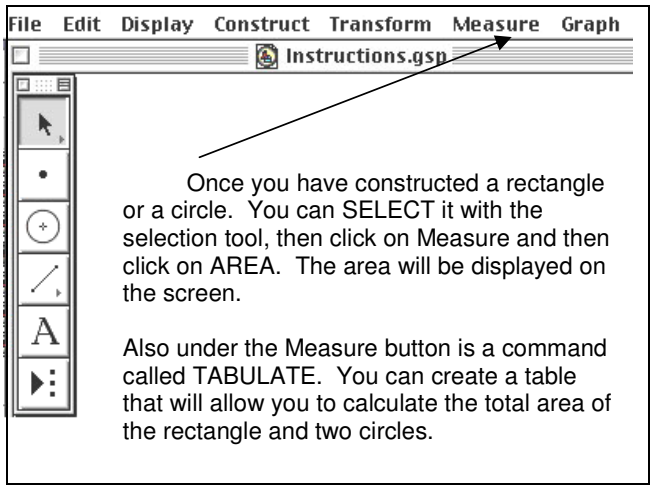
d = 22 inches

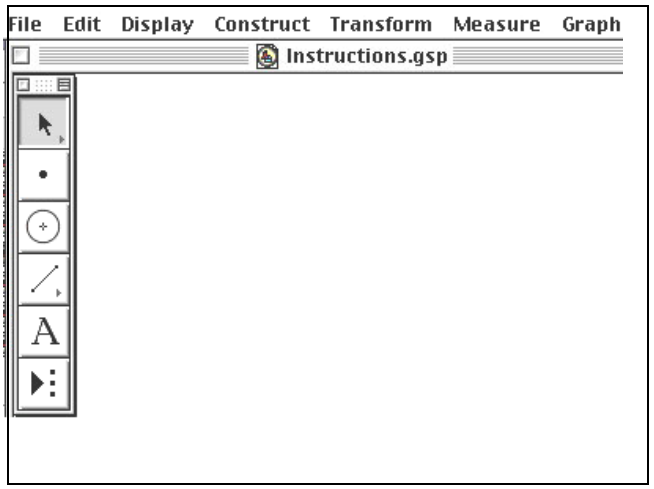


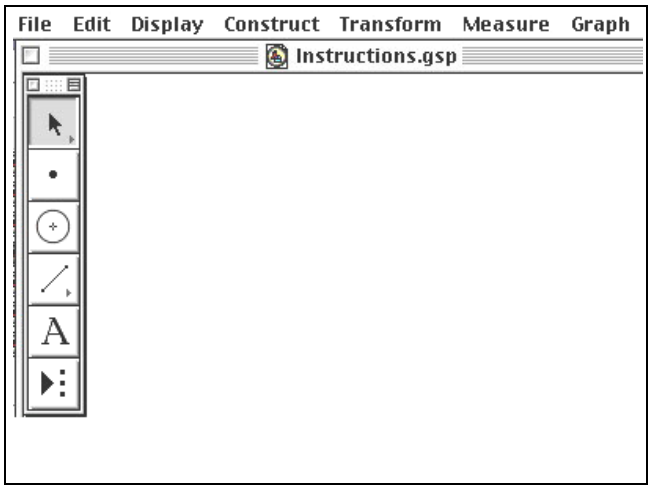
7.9.4: GSP Instructions for Students

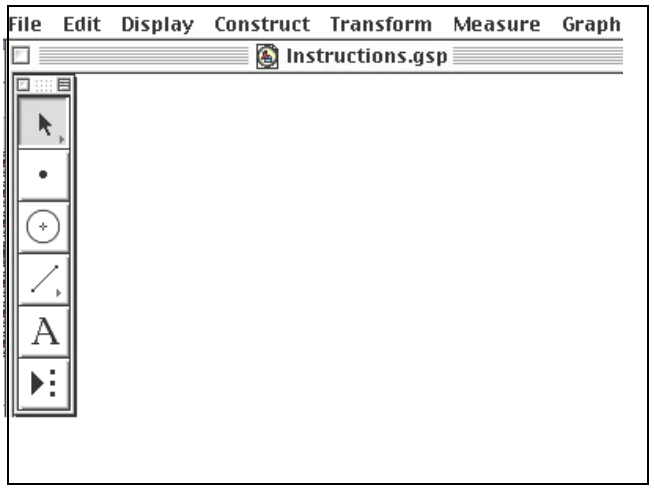










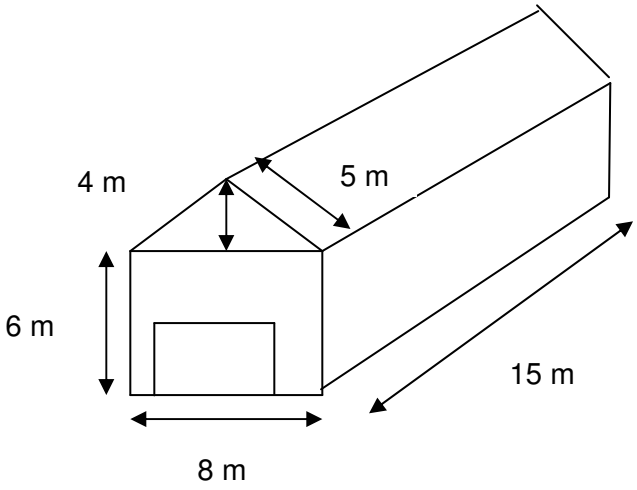


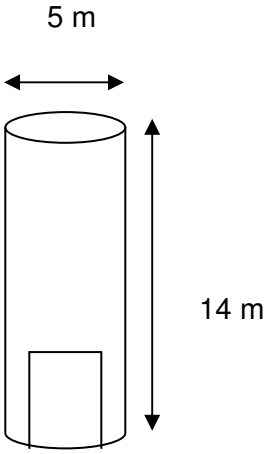
7.10.1: Old McDonald

Old McDonald wants to paint his barn-house and silo. The entire barn-house and silo will be painted red, EXCEPT for the two doors – those will be painted white. Be aware that it is not possible to paint the bottom of the barn-house and silo.

Note: A silo is a structure for storing bulk materials such as grain, coal, cement, carbon black, wood chips, food products and sawdust.

Here is what the barn-house and silo looks like:





The door of the barn-house has dimensions of 5 m wide by 4 m tall.

The door of the silo has dimensions of 3 m wide by 5 m tall.

1. a) What is the area of the **barn-house door** that will be painted white?

b) What is the area of the **barn-house** that will be painted red?

7.10.1: Old McDonald (Continued)

2. a) What is the area of the **silo door** that needs to be painted white?

   b) What is the area of the **silo** that will be painted red?

3. a) What is the **total** surface area that will be painted red?

   b) What is the **total** surface area that will be painted white?

4. a) What would the answer to 3a) be in squared feet?

   b) What would the answer to 3b) be in squared feet?

7.10.1: Old McDonald (Continued)

5. If one can of paint will cover a total of 1000 ft^2:

   (a) How many cans of white paint will Old McDonald need to buy? Justify your answer.

   (b) How many cans of red paint will Old McDonald need to buy? Justify your answer.

   (c) How many cans of paint will Old McDonald need to buy in total? Justify your answer.

7.10.2: Old McDonald - Rubric

Selecting Computational Strategies				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Select and use strategies to solve a problem	Selects and applies appropriate strategies, with major errors, omissions, or mis-sequencing	Selects and applies appropriate strategies, with minor errors, omissions or mis-sequencing	Selects and applies appropriate strategies, accurately, and logically sequenced	Selects and applies the most appropriate strategies, accurately and logically sequenced
Communicating				
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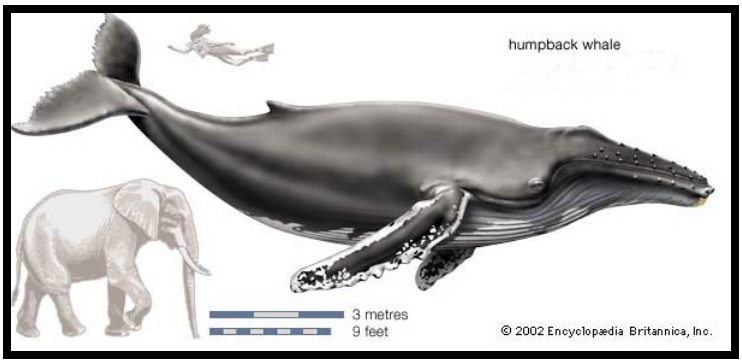
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections

7.11.1: Count on Frank

One of the facts shared in the book 'Counting on Frank' is that only ten humpback whales would fit in his house. When answering the questions below, use either metric or imperial units.



1. How big is the average humpback whale (estimate)?

2. What type of box can we fit the whale in (e.g. rectangular, triangular, cylindrical or other)?

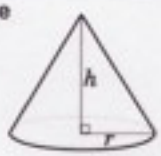
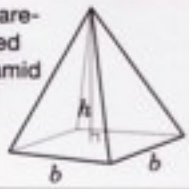
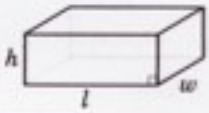
3. What size of box would you need to fit one whale?

4. Determine the dimensions of the box.

5. Imagine ten of these boxes, how much space would that fill?

6. How big is the house?

7.11.2: Formulas to Know!

Geometric Figure	Volume
Cylinder 	$V = (\text{area of base})(\text{height})$ $V = \pi r^2 h$
Sphere 	$V = \frac{4}{3}\pi r^3$ or $V = \frac{4\pi r^3}{3}$
Cone 	$V = \frac{(\text{area of base})(\text{height})}{3}$ $V = \frac{1}{3}\pi r^2 h$ or $V = \frac{\pi r^2 h}{3}$
Square-based pyramid 	$V = \frac{(\text{area of base})(\text{height})}{3}$ $V = \frac{1}{3}b^2 h$ or $V = \frac{b^2 h}{3}$
Rectangular prism 	$V = (\text{area of base})(\text{height})$ $V = lwh$
Triangular prism 	$V = (\text{area of base})(\text{height})$ $V = \frac{1}{2}blh$ or $V = \frac{blh}{2}$

OCTOBER 2007

7.11.3: Shapes to Go!

STATION 1

Part A

Using an Interactive White Board or laptop, you will be investigating the volume of a rectangular prism.

GETTING STARTED!
(i) Open the website
http://www.learner.org/interactives/geometry/
(ii) Click on the '*Surface Area and Volume'* Tab
(iii) Click on the tab labeled '*Volume: Rectangles'*.

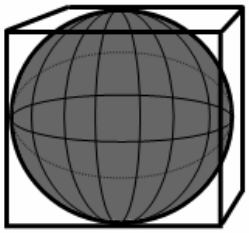
Read through the introduction and then answer the questions provided.

When finished, scroll down and select the 'Find Volume of Another Prism' option.
Fill in the chart provided below.

Prism	# of unit cubes forming the base	Layers needed to fill prism	Volume of prism
1			
2			
3			
4			

Part B

Determine the volume of empty space that is in the box that holds exactly a basketball ball with a diameter of 18 inches.



7.11.3: Shapes to Go!

STATION 2

Your goal is to show how the volume of a cone is related to the volume of a cylinder.

Your task:

1. Compare the base of the cone with the base of the cylinder. What do you notice?

2. Compare the height of the cone to the height of the cylinder. What do you notice?

3. How many times do you think you would be able to fill the cone with water and pour it into the cylinder before it overflows? Fill in the blanks below. Fill in the bolded components after you perform the experiment.

Guess: _____ **Actual:** _____

Therefore, the volume of a cylinder is _____ times greater than the volume of a cone.

LETS TRY IT!

i. Fill the cone full with water.
ii. Empty the water from the cone into the cylinder.
iii. Repeat until the cylinder is completely full (keep track of how many times it takes).

4. From your findings, come up with a formula for the volume of a cone using the volume of a cylinder as a base.

7.11.3: Shapes to Go!

STATION 3

Your goal is to show how the volume of a square-based pyramid is related to the volume of a cube.

Your task:

1. Compare the base of the cube with the base of the pyramid. What do you notice?

2. Compare the height of the cube to the height of the pyramid. What do you notice?

3. How many times do you think you would be able to fill the pyramid with water and pour it into the cube before it overflows? Fill in the blanks below. Fill in the bolded components after you perform the experiment.

Guess: _____ **Actual:** _____

Therefore, the volume of a cube is _____ times greater than the volume of a pyramid.

LETS TRY IT!

i. Fill the pyramid full with water.
ii. Empty the water form the pyramid into the cube.
iii. Repeat until the cube is completely full (keep track of how many times it takes).

4. From your findings, come up with a formula for the volume of a pyramid using the volume of a cube as a base.

7.11.3: Shapes to Go!

STATION 4

Imagine a steaming hot summers day and you run into the house after a long bike ride. You rush to the kitchen and open the cupboard to see only two glasses remaining. One is tall and thin and the other is short and wide. You are so relieved because, thanks to your math classes, you are confident that you can choose the glass that holds the most amount of juice.

1. Take a look at the glasses at your station. Which glass would you choose to quench your thirst? Using what you have learned about the volume of 3-D objects, justify your choice.

LETS EXPERIMENT!

i. Fill the taller glass to the top with water.
ii. Transfer the water from the taller glass to the shorter glass.

Are you surprised at what you see?

2. Using the measurement device provided, calculate the volume of both the tall and short glasses.

3. Compare your height and radius measurements of the glasses.
   a) What do you notice?

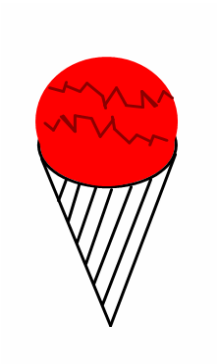
   b) Does height or radius have a greater effect on the volume of a cylinder? Why?
   (HINT- Refer to the volume formula for a cylinder)

4. Most people would say that the volume of the taller glass exceeds the volume of the shorter glass. Why might they have this perception?

7.11.4: Two Shapes Are Better Than One

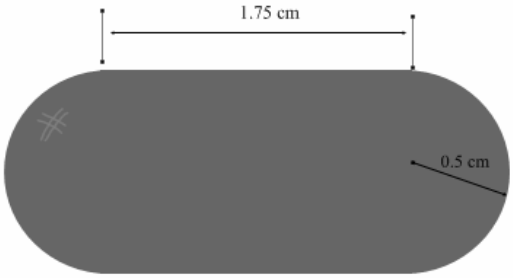
Problem 1

Determine the volume of ice-cream if the diameter of the scoop is 10 cm and the height of the cone is 20 cm. What possible assumptions are made when solving this problem?



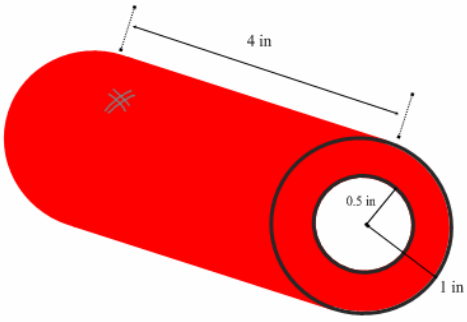
Problem 2

Determine the volume of medicine that will fill the following capsule. What possible assumptions are made when solving this problem?



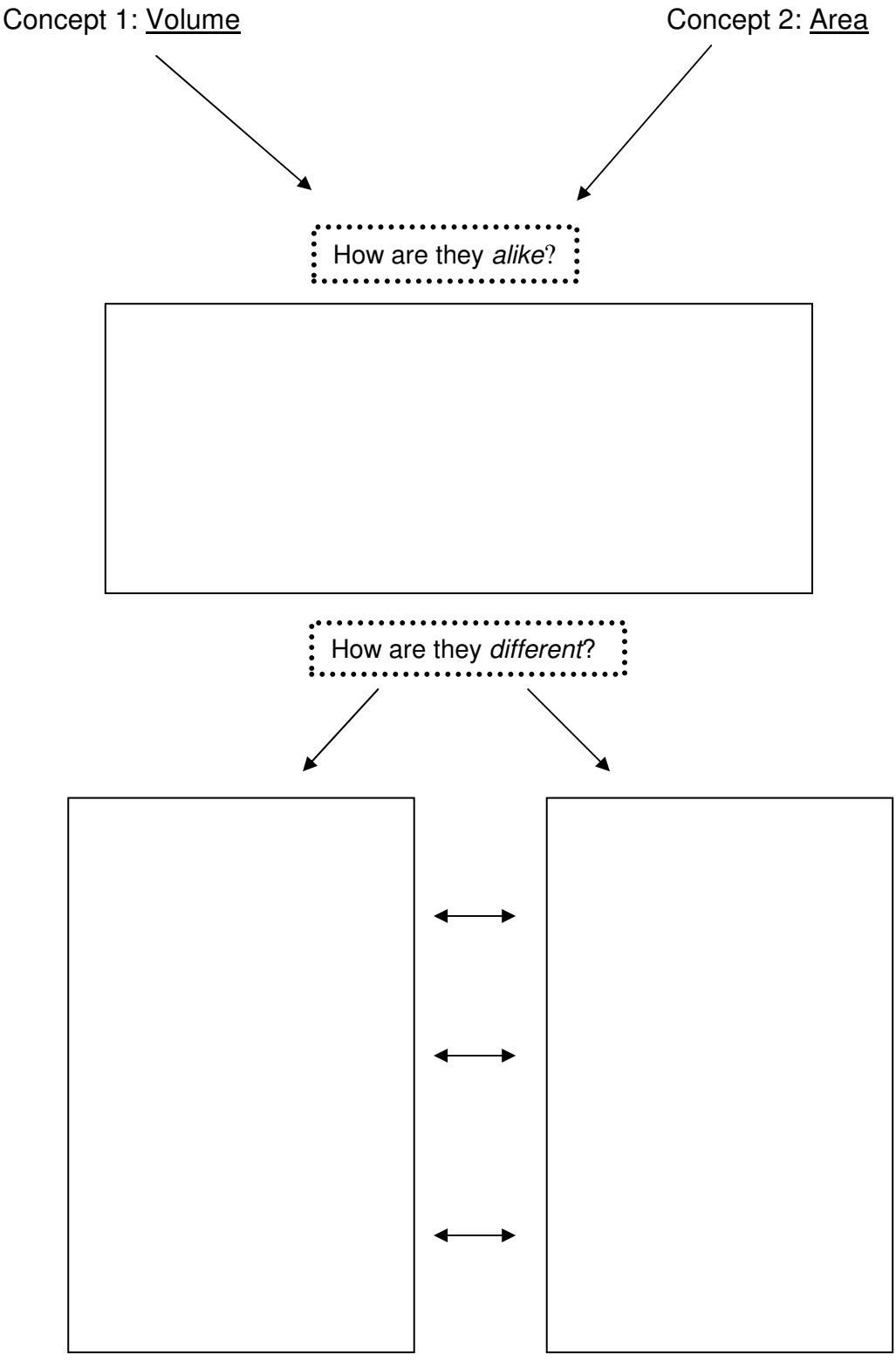
Problem 3

Determine the volume of cake that is surrounding the cream filling.



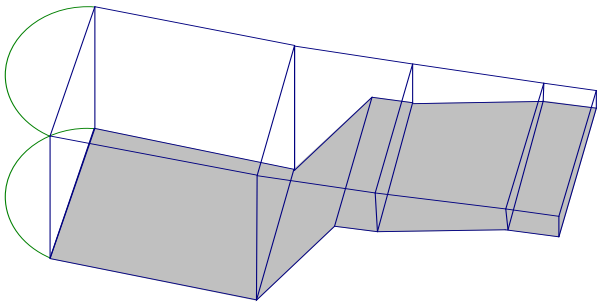
7.11.5: Mega Mind Map!

Comparing Concepts- Volume & Area



7.12.1: Pumping Up the Volume

Solving problems dealing with three-dimensional objects is similar to pulling a puzzle apart; pieces need to be thought of separately. The following swimming pool problem illustrates this.

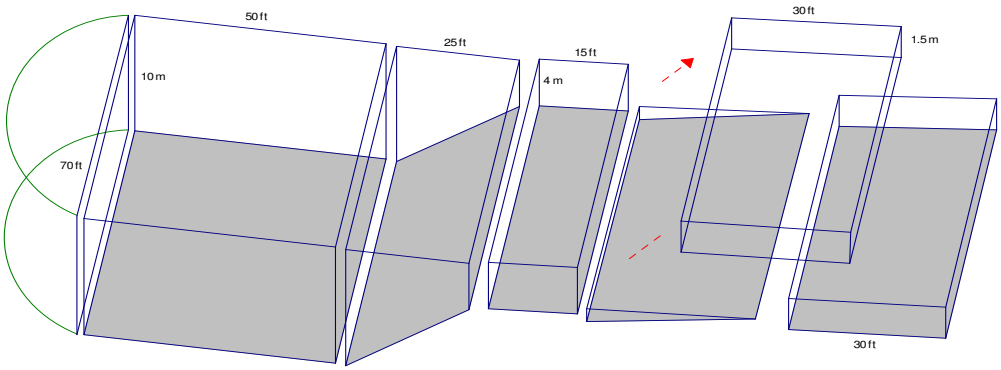


Part A: Pool Volume

Determine the volume of water, in cubic feet, needed to fill the above municipal swimming pool.

Steps

1. Break up your three-dimensional object into the basic objects; such as cylinders, rectangular and triangular prisms etc. This will make determining the volume of these objects much simpler.



2. One method of breaking up the object is shown above. The pool has been broken into seven objects. How many other ways could you break up the pool?

3. Label each section of the pool shown in step 1 above with the letters A, B, C, D, E, F and G, and identify the geometric shapes.

A: _____ B:_____ C:_____ D:_____

E: _____ F:_____ G:_____

4. The problem asks you to determine the volume in cubic feet. Are there any lengths that need to be converted? If so, convert them.

7.12.1: Pumping Up the Volume (Continued)

5. Calculate the volume for each section. Use the space below to organize your work.

Object A	Object B
Object C	Object D
Object E	Object F
Object G	

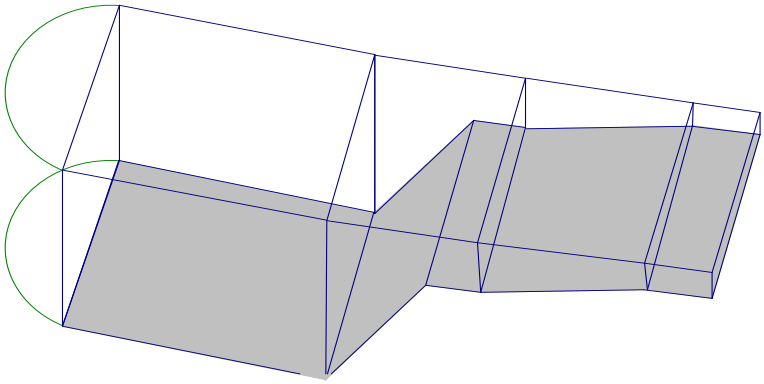
6. Determine the total volume of the swimming pool, in cubic feet.

7.12.2: Pool Management

The building code indicates that when filling swimming pools, there must be a 6-inch gap between the water level and the top of the pool (at ground level). Using your results from '**7.11.1: Pumping Up the Volume',** calculate the volume of water that is needed to fill the pool so that it can meet the building code.

Steps

1. Sketch the volume of the space that will not have water.



2. Label the dimensions needed.

3. Calculate the total volume of water that will be in the pool if the building code is to be followed.

4. The chlorine to water ratio is 130 grams to 10 000L. If chlorine is purchased in 130 gram bags, determine the amount of chlorine that is needed, in kilograms, to chlorinate the pool ($1\ ft^3 = 28.3168$ Litres).

7.13.1: Feeling Isolated

Look at the following equations. Next, look at the steps that are at the bottom of the page.

You need to put the steps under the correct equation, in the correct order. The steps should be listed in such a way that you would be able to isolate the variable by following these steps.

Equation: 22 = 3x + 7	**Equation: 6t – 8 = 34**
Equation: m/2 + 6 = 18	**Equation: -21 = 3 – 8z**
Equation: 4k – 5 = -25	**Equation: x/4 + 9 = -1**

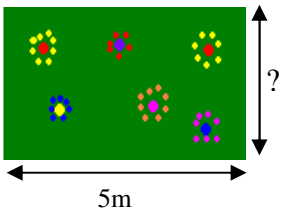
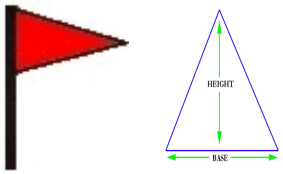
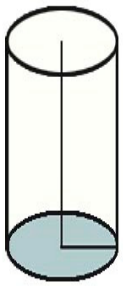
Steps

Subtract 3	Divide by 3
Add 8	Subtract 7
Multiply by 2	Subtract 6
Subtract 9	Divide by negative 8
Divide by 4	Multiply by 4
Divide by 6	Add 5

7.13.2: Solving Measurement Problems

1. The area of a rectangle is 72 cm^2. The length is 3 cm. What is the width?	2. The area of a triangle is 32 cm^2. The base of the triangle is 4 cm. What is the height?
3. Here is the formula for the area of a trapezoid: $A = [(a + b) \times h] \div 2$. If the Area is 19.5 cm^2; a = 7 cm and b = 6 cm, what is the height of the trapezoid?	4. The volume of a cylinder is given by the formula $V = \pi r^2 h$. If the radius of the cylinder is 8 inches and the volume is 2411.52 in^3, what is the height of the cylinder?
5. The volume of a rectangular prism is 120 cm^3. The length of the base is 6 cm and the height of the prism is 10 cm. What is the width of the base of the prism?	6. The volume of a square-based pyramid is given by the formula $\frac{1}{3}(l \times w) \times h$ [where l is the length of the square base, w is the width of the square base and h is the height of pyramid]. If the base has a side length of 6 cm, and the volume is 396 cm^3, what is the height?

7.13.3: Don't Feel Isolated

Role	Audience	Format	Topic
Landscape Architect	Customer	Mrs. Rose wants a rectangular shaped garden planted off the back of her house. She can only afford to plant flowers in an area of $15m^2$. She really wants the garden to be 5m in length. How far from the house will the garden stick out?	Rectangle 
School Sports Team Manager	School Council	You are designing a flag for the upcoming Football Game. Tradition says that the flag must be triangular. The base of the flag has to be 15 inches and you only have enough material to cover an area of 150 square inches. What will be the height of the flag according to these restrictions?	Triangle 
Packaging Designer	Candy Manufacturer	A brand new sugary treat has been invented. The volume of one candy is 1.6 cm^3 and its radius is 1 cm. How long would you need the cylindrical package of candy to be if you need 20 candies to fit in one tube?	Cylinder 
Carpenter	Contractor	An entertainment unit needs to be built for a new home. The cabinet has to have a volume of 1.01 m^3 so it can hold the TV and stereo that the owners recent purchased. In order to fit the space provided, both the height and length of the unit have to be1.2 m. How far will the unit stick out from the wall when complete?	Rectangular Prism